

## 9. CONCLUSIONS AND RECOMMENDATIONS

### 9.1 CONCLUSIONS

The assessment team submits the following conclusions regarding the preliminary assessment of tributary habitat available upstream from five Yakima River basin dams and opportunities for providing passage for anadromous salmonids at the associated dams. The team considered issues such as how to expedite passage and restoration of anadromous salmonid populations, data gaps that need to be addressed, and engineering concerns.

■ **There are definite benefits to restoring fish passage at Yakima Project storage dams.**

Providing passage at Yakima River basin dams would allow anadromous salmonids the opportunity to expand their range into historically occupied areas. Passage would also restore connectivity of historic bull trout habitat that could improve gene flow among currently isolated populations. Passage facilities would allow opportunities for greater expression of the full range of salmonid life history strategies. We believe that passage facilities could also improve overall watershed productivity through the infusion of marine-derived nutrients to stimulate aquatic production. As a result, bull trout may experience a more stable and abundant forage base, which would affect them positively. In addition, fish passage facilities are expected to provide secondary or indirect benefits to the existing fish species assemblages of the reservoirs and tributaries.

Nothing in the Phase I assessment suggested that providing passage for anadromous salmonids and the eventual restoration of fish populations at any of the reservoirs is undesirable. Although some adult and juvenile passage options have substantial implementation costs, in this Phase I effort we neither considered nor evaluated alternative activities such as habitat improvement projects elsewhere in the basin that might provide equivalent or greater biological benefits.

■ **It is technically feasible to construct fish passage facilities at all five Yakima Project storage dams.**

It appears to be technically feasible, although costly, to provide passage for anadromous salmonids and bull trout at each of the five Yakima Project storage reservoirs. Several upstream and downstream passage options were considered for each reservoir, varying in design concept, passage window for adults and juveniles, and cost. Limited passage can be provided at each dam with relatively minor modifications to infrastructure. However, this would only provide a narrow passage window for downstream migrants, if spilling over the existing spillway is an acceptable strategy. Longer passage windows can be provided with increasing cost and construction sophistication.

Passive (volitional) adult and juvenile fish passage with a long time window (i.e., over a wide range of reservoir operational elevations) is difficult to achieve and may be cost-prohibitive at most of the reservoirs. One exception is Bumping Lake Dam, where because of its relatively low dam height

and hydrologic regime, it may be possible to construct a gravity fish ladder that would provide almost year-round volitional adult and juvenile passage under current reservoir operations. But the biological benefit expected for Bumping Lake Dam, as measured by miles of tributary habitat potentially accessible, is much smaller compared to other fish passage projects, thereby significantly inflating the cost in relation to benefits to anadromous salmonid populations.

- **Longer passage windows would provide the greatest biological benefits for migratory species.**

Because of the number of anadromous salmonid species and life history strategies, it is probable that some life history stage would use passage facilities most months of the year, if passage were available. There are identifiable peak use times when passage facilities would be used by greater numbers of fish that are also within the readily achievable operational regimes of the reservoirs. While any level of adult and juvenile fish passage will be beneficial, the greater the window when fish can pass, the more species, life history stages and strategies that can be supported. The length of the fish passage window is also directly related to the cost of construction.

Operational changes under some circumstances might improve juvenile fish passage windows at one reservoir, but this could be at the expense of the passage windows at other reservoirs. Accordingly, there is a cost and operational flexibility trade-off that must be made to provide passage at all Project reservoirs. The benefits to the species and tradeoffs should be examined from a systems perspective jointly by Reclamation and the fish managers to determine the most advantageous configuration for upstream and downstream passage.

There were limited discussions regarding how operational changes might be used either separately or in conjunction with engineering approaches to improve or extend the time windows during which passage could be provided for anadromous salmonids or bull trout. In-depth studies of potential operational changes were not done in Phase I and will be considered in Phase II and later studies.

- **Suitable habitat is available for anadromous and resident salmonids in the tributaries above the dams.**

There is generally good quality habitat upstream from the reservoirs, ranging from about 2.35 miles upstream from Kachess Lake to about 36.8 miles upstream from Rimrock Lake. Quality of the accessible habitat is not uniform across all watersheds, but considering numerous environmental factors, the overall quality can be considered good, and would support anadromous salmonids. Many of the Yakima River basin bull trout populations currently reside above the reservoirs, although most of these stocks are depressed or at critical population levels. General isolation likely contributes significantly to this decline. Habitat quality is generally good, although several spawning streams have problems with seasonal dewatering. Assessment of habitat will be refined in Phase II and later studies to help establish priorities for implementation of passage facilities at the different sites.

- **It is likely that self-sustaining populations of anadromous salmonids and bull trout connectivity could be restored if passage is provided.**

Over the “long term” (10 generations or so), anadromous salmonid populations in the tributaries upstream from the reservoirs could be expected to become self-sustaining. This is expected to occur

concurrently with expansion and restoration of populations in the Yakima River basin downstream from the dams. However, it must be recognized and acknowledged initially that anadromous salmonid populations in the entire Columbia River basin are for the most part at reduced population size and extensive restoration efforts are in progress to restore or improve populations throughout the basin. We should not expect quick results or substantial increases in the populations to occur in the short-term.

## 9.2 RECOMMENDATIONS

### ■ **Recommendation 9.2.1 — Contingent upon available funding, evaluate two reservoirs in greater detail in Phase II.**

We recommend that fish passage and its potential biological benefits be studied during Phase II in greater detail at Cle Elum Dam, and either Tieton Dam or Bumping Lake Dam, contingent upon available funding. These reservoirs present substantially different opportunities for developing fish passage concepts, expediting restoration of anadromous salmonids populations, and studying bull trout movement patterns.

A detailed study of these reservoirs would provide both Reclamation and fisheries managers an opportunity to develop a systematic, phased approach to evaluating fish passage concepts as well as developing a plan to evaluate the consequences of introducing long extirpated fish species back into the watersheds upstream from selected dams.

The upper Cle Elum River watershed has a substantial amount of habitat and there appears to be some opportunity for flexibility with respect to reservoir operations. In addition, Reclamation has authority under YRBWEP to provide juvenile fish passage at Cle Elum Dam.

Bumping Lake has a relatively modest amount of tributary habitat and potential for restoring anadromous salmonid populations. However, its relatively low dam height, substantial water supply and operational flexibility would allow construction of technologically simple, year-round volitional passage facilities (at significant cost) or allow a broad window of relatively inexpensive salmonid passage using surface spill for juvenile passage and trap-and-haul for adult passage.

Tieton Dam presents some challenges in providing downstream passage for outmigrating juvenile fish. If Tieton Dam is considered, we should also consider installing a fish trap at Tieton Diversion Dam ladder and starting trap-and-haul and spill operations for whichever passage window is feasible.

### ■ **Recommendation 9.2.2 — Contingent upon funding, continue in Phase II to evaluate tributary habitat initiated in Phase I.**

Conduct a more thorough evaluation of the tributary habitat that was identified in Phase I. Through a combination of remote sensing and field work, assess the quality and quantity of accessible stream miles as well as any additional habitat that would be available if man-made barriers to fish passage were removed or improved.

We recommend that the tributary habitat upstream from each of the selected dams in Phase II be evaluated in more detail initially from aerial photography as well as in the field in order to:

- Better characterize the extent and quality of accessible tributary habitat,

- Clearly locate, identify, and characterize barriers to fish movement from the lake upstream to the first substantial natural barrier insurmountable to anadromous salmonids at all flows,
- Identify any measures necessary to facilitate restoration of anadromous salmonid populations and enhance connectivity of bull trout habitat.

■ **Recommendation 9.2.3 — Plan for operational adjustments**

Fish passage facilities should be designed to operate to take advantage of potential future changes in Yakima Project operations.

■ **Recommendation 9.2.4 — Evaluate potential operational changes, including new basin storage, to determine possible benefits to fish passage.**

■ **Recommendation 9.2.5 — Monitor results of passage and restoration activities and institute an adaptive management approach as part of Phase III.**

Restoring anadromous salmonid populations upstream from Yakima Project storage dams presents significant challenges. The design of the dams and large natural reservoir fluctuations makes these facilities much different than the other dams on the Yakima and Columbia rivers where fish passage has been addressed. Experience has shown us that there is a significant amount of “trial and error” learning associated with correcting or removing barriers to anadromous salmonid passage. It is therefore essential to monitor rigorously any activities implemented to provide fish passage or expedite anadromous salmonid restoration efforts. Since results of any course of action taken will require years to obtain and evaluate, an adaptive management approach must be incorporated into the overall program since unanticipated events and results will need to be considered or addressed. An adaptive management approach will allow managers and engineers to respond to unforeseen events or unexpected results by refining structural and operational measures.

■ **Recommendation 9.2.6 — As part of Phase II efforts, develop a detailed scope of work for Phase III and later stages of the feasibility study in collaboration with other entities and organizations involved with fish passage and recovery issues in the Yakima River basin.**